APPENDIX I

BATHYMETRIC SURVEY AND ADCP DATA COLLECTION REPORT

SAN JACINTO RIVER WASTE PITS SUPERFUND SITE

Prepared for

U.S. Environmental Protection Agency, Region 6

On behalf of:

McGinnes Industrial Maintenance Corporation

and

International Paper Company

Prepared by

Anchor QEA, LLC

614 Magnolia Avenue

Ocean Springs, Mississippi 39564

September 2010

TABLE OF CONTENTS

List of Figures

1 INTRODUCTION

1.1 Brief Resume of Firm

The hydrographic and topographic surveys were performed by Hydrographic Consultants. Hydrographic Consultants, Ltd. (HCL) in February 2009 and June 2010. HCL specializes in meeting the challenges of maintaining up-to-date standards and equipment in this ever-changing environment, with the purpose of providing service and support to both the public and private sector in pursuit of their hydrographic survey needs in the marine environment.

2 EQUIPMENT UTILIZED

Topographic Equipment – set tide gauge from HGCSD 33:

- RTK – Trimble 5700/ Trimble 5800 with Trimmark III Radio
- RTK Software – Trimble Survey controller and Trimble Geomatics Office

Hydrographic Equipment:

- Echo sounder – Odom CV100 using a 4 degree 200 KHz transducer
- Positioning – Trimble DMS 232 using U.S. Coast Guard Navigation Beacon Corrections (DGPS – sub meter accuracy)
- Survey Software – Hypack operating on laptop with helmsman monitor
- Survey Vessel – HCL used the survey vessel "Surveyza" which is a 19 foot Carolina skiff with less than 1 foot draft. This type of vessel can operate in shallow waters which was necessary to cover the area required for this survey.
- Tide – HCL used 2 Onset gauges that use water pressure to monitor water elevation.

3 METHODS

Project Manager, Mr. Robert A. Roman, P.E. is an American Congress Survey & Mapping Certified Inshore Hydrographer. All bathymetric surveys and data processing were under his direct supervision. He supervised the ADCP deployment and data extraction for the Anchor QEA, LLC team.

1. Tide Gauge(s)

- RTK technology was employed to check and set vertical control for monitoring the water elevation. Due to the extent of the project and the water constriction at the I-10 overpass, HCL proposed to monitor water elevations at 2 locations, upstream and downstream of I-10. The gauge deployed was dependent upon the area HCL was surveying on any particular day.
- All vertical control was set from HGCSD 33 and checked to other HGCDS monuments in the area. If any discrepancies were found, HCL notified Anchor QEA immediately before continuing with work.
- Tide gauges are electronic and measure water elevations based upon monitoring water pressure and barometric pressure (necessary to cancel out atmospheric effects on water pressure). Gauges monitored water elevation on 30 second intervals during the course of the survey.

2. Hydrographic Survey
    - The hydrographic survey was performed using survey procedures, data collection equipment, methods and densities and equipment calibration for this work followed the criteria for Navigation and Dredging Support Surveys for soft bottom materials as given in the U.S. Army Corps of Engineers Hydrographic Survey Manual EM 1110-2-1003, dated January 2, 2002. HCL regularly performs hydrographic surveys to these standards and is thoroughly familiar with the USACE document and the accuracy requirements.
    - As noted in Section 5.1.1 – the proposed grid was developed based upon both HCL's knowledge of the area and the requirements for preparing an accurate 3-D model.
    - Surveys were to DGPS (sub meter) horizontal accuracy and to a vertical accuracy consistent with the USACE requirement for dredging support surveys for soft bottom materials.
    - Surveys were conducted using hypack software integrated with the echo sounder and DGPS positioning systems to continuously in real-time record both position and depth along the course of each transect.

HCL utilized a shallow draft Carolina Skiff with a center hull transducer. This allowed HCL to maximize the access in the areas of limited depth of water. Additionally, HCL included extra time in the cost proposal to account for having to cover much of the area during periods of high tide.

4 SURVEY FEBRUARY 2009

4.1 Grid Survey Pattern Based on Knowledge of the Area

HCL reviewed the primary survey area boundary in conjunction with aerial data of the San Jacinto Waste Pit Site and NOAA chart 11329 and concluded that a grid layout is not the optimal layout to economically model the area. Rather than survey a grid pattern, HCL proposed to survey a series of transects that best model:

- The San Jacinto River contour
- The terrain surrounding the waste pit Site, and
- Denote channel features surrounding or leading to the waste pit Site

GENERAL LAYOUT NOTE: HCL prepared the plan based on their knowledge of the area and as an efficient transect density to model the area for the RI/FS work plan. Anchor QEA added additional transects necessary to cover the area, HCL adjusted the proposal accordingly. The survey pattern for the area was laid out as such, with the area shown on Figure 8 being collected in the June 2010 effort as part of the TCRA activities:

4.1.1 Section I – South of I-10

The pattern for South of I-10 was a set of transects to map pattern of San Jacinto River as well as the area shown on NOTE A of Figure 1; this figure also displays the survey transects in red.

- Note A: A "Channel" is shown on the NOAA chart (dashed green area). HCL added transects to properly model this channel.

Also, HCL worked in this area before and much of the area noted as barge mooring area had barges and other vessels moored in that area. HCL worked around moored vessels, so the transect path deviated from the proposed path in areas where obstructions exist. Note that this area was not surveyed as part of the TCRA effort and is displayed to show continuity with the RI/FS Work Plan efforts.

4.1.2 Section II – North of I-10

The survey pattern displayed in Figure 2 consists of lines setup to best model the San Jacinto River Basin and general bathymetric contours shown on NOAA chart (Red Transects). Also, HCL defined what appeared to be a deeper area leading to the site (Blue Transects). Note Western most Blue transect, is Anchor QEA's Line #15.

The hatched portion of Figure 2 is the area immediately surrounding the waste pit area. The survey pattern for this area was not based on the NOAA charts, rather on the interpretation of aerial data. Section 5.1.3 details the work done in this area.

4.1.3 Section III – Surrounding Area of Waste Pit Site

Through a review of aerial data, HCL identified underwater bottom features visible at low tide. The hatched area in Figure 2 represents the surrounding area and waste pit site. Figure 3 shows an oblique view of the area where shallow water can be seen as well as cuts through the area. Also visible are remnants of land on the lower left near I-10.

Figures 2 and 4 show the I-10 North plan based on the NOAA contours, with Figure 4 showing an overlay on a low tide aerial photo. As Figures 3 and 4 shows, there are other features that needed to be defined to accurately model the area. A deep area that appears to connect with the "channel" leading into the back of the pit site is visible. Also visible are shallow bank areas surrounding the deep area. These areas in addition to the cut across the top of the area, peninsula and other features visible at low tide needed to be surveyed.

HCL denoted some of the additional bathymetry (blue lines) that were used to map features not visible on the NOAA chart, but visible in the aerial photos (most notably defining the shallow banks surrounding the deep water. However, other bathymetry was taken as needed in the field to document the existing bottom features as visible on the aerial data. Additionally, much of these features are shallow – so this area needed to be covered at high tide.

HCL allotted time in the cost proposal to pickup any features that were noticed in the field that were not adequately covered to model the area for development of the 3 foot X 3 foot grid or CAD contours.

4.2 Description of Interpolation Method to Generate 3-Foot Grid Data

4.2.1 3-D Modeling Method

To develop the 3 foot X 3 foot Grid a 3-D model from the survey was first developed. HCL utilized Trimble's Terramodel software for 3-D modeling. The key to any modeling is to;

- Collect data in such a manner that there is both sufficient density and data is collected at key contour changes and perpendicular to those contour changes. The survey pattern for the prepared by HCL in the designated area has been setup to provide sufficient data at key locations to economically model the area.
- Aid the modeling process by using break lines to link points of similar elevation and "steer" or direct the linking of data such that the model best reflects the actual conditions. Without break lines the closest points are linked and in most instances the computer software alone will not correctly model the area. (see example below)

Figure 5 shows a survey where the survey lines (magenta) were taken perpendicular to a contour (in this case a pipeline). Below the survey pattern in Figure 5 is Terramodel's 3-D model based on survey line data. In general the pipeline was discernable in the model.

Figure 6 shows a survey where the data was taken askew of the pipeline. This would be an example of the data not being perpendicular to a contour. The result was that the software created a 3-D model that was not representative of the area. Instead of 1 pipeline it appeared that multiple ridges exist.

This is an example of how the software alone could not generate the contours – the software linked the closest points, not the natural contour. Figure 7 on the following shows how the data processors used break lines to aid the modeling of the data even in situations where the data were not perfectly perpendicular to the contour.

By using break lines to aid in 3-D modeling, even in the worst circumstances (lines askew to the natural contour) a surface can be developed. In Figure 7, break lines were added to show how the data points should be linked. The result was a surface that, although not as perfect as that shown in Figure 5, provided a reasonable representation of the bottom.

The purpose of this example is to demonstrate that computer software alone does not inherently provide the best surface model of an area. As such, HCL 1) prepared a survey plan that provided the best starting point for a computer modeling of the area and 2) included in the budget data processor time to develop the model from the survey data acquired.

Once the base survey data were edited, it was color plotted and overlaid in such a manner that the data processor determined where break lines needed to be added. Additionally, as HCL prepared the survey layout with the assistance of the NOAA charts, HCL also used those charts with their contouring to assist in placing break lines.

The final stage was to review the 3-D model of the survey to ensure that the model properly reflected the bottom topography. Once the 3-D model was developed and accepted then the "Terramodel" software generated data on a 3 foot X 3 foot grid.

5 SURVEY JUNE 2010

5.1 Survey Pattern Based on Knowledge of the Area

HCL revised the layout per the information provided by Anchor denoting the areas of concern. Figure 8 below displays the revised layout.

5.2 ADCP Deployment

HCL deployed Anchor QEA's SonTek Argonaut-SW ADCP at the location specified in the work plan. Figure 9 displays SonTek's specifications sheet for the Argonaut-SW, and Figure 10 displays the gage deployment platform. HCL also retrieved, managed, and downloaded the ADCP data. These data collected were necessary for Anchor QEA's draft hydrodynamic model simulations.

Data was collected for the 21 day period from June 16, 2010 to July 6, 2010, to calibrate the hydrodynamic model. A plot of the data and the ADCP deployment location are shown in Figures 10, 11, and 12 of Appendix G.

FIGURES

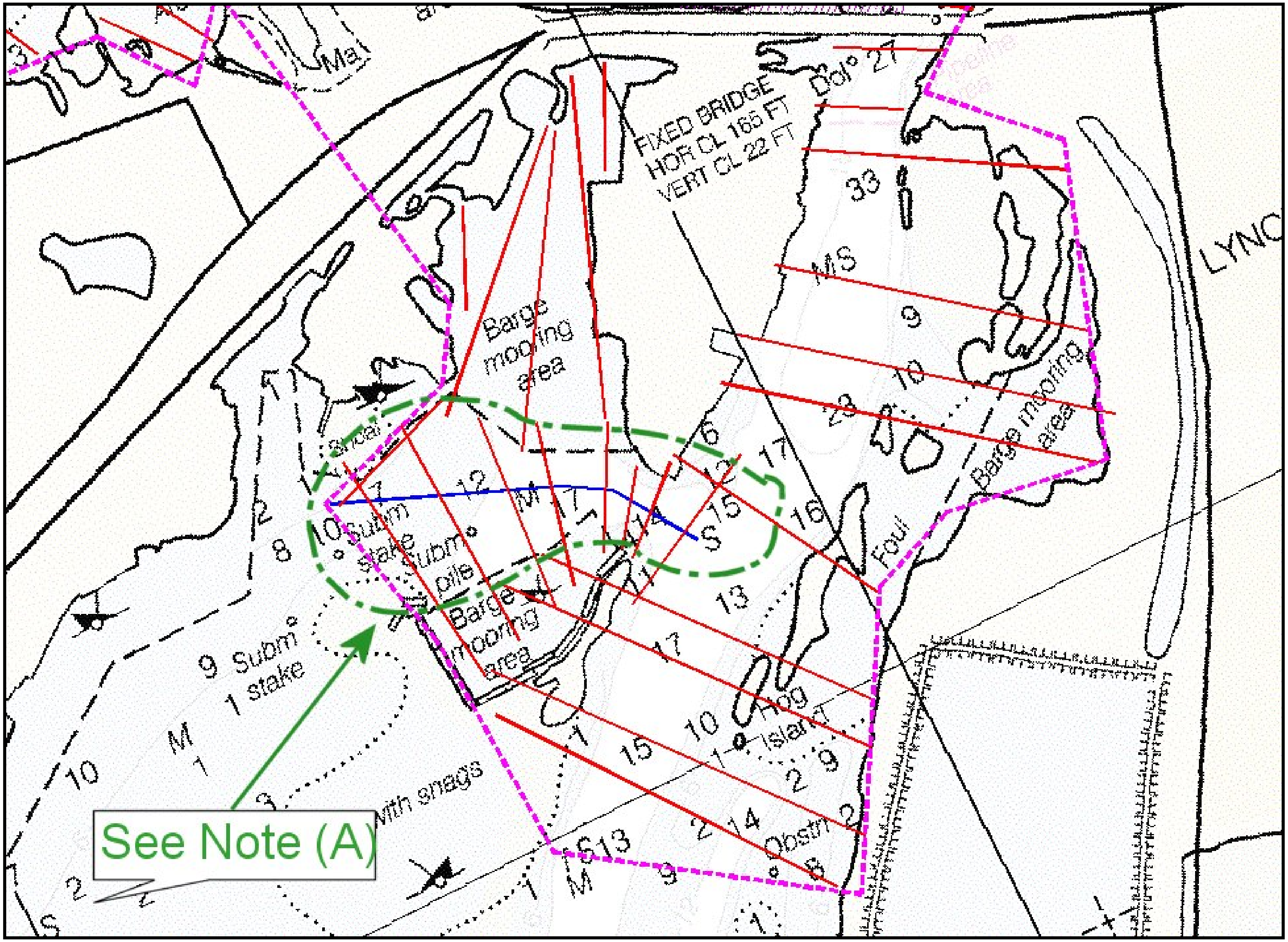


Figure 1
Survey Layout South of I-10
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

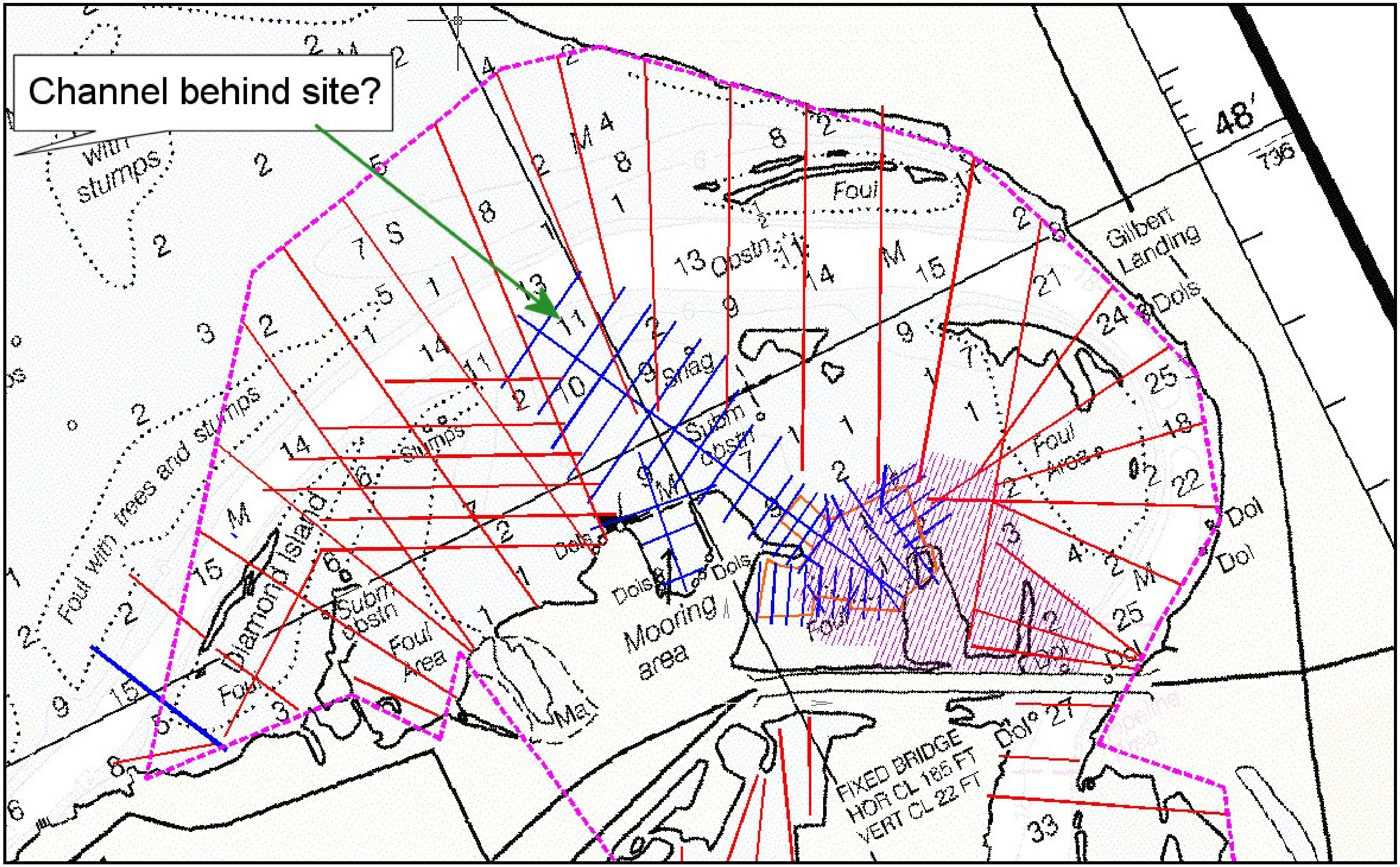


Figure 2

Survey Layout North of I-10

Hydrographic Survey and ADCP Data Collection

San Jacinto River Waste Pits Superfund Site

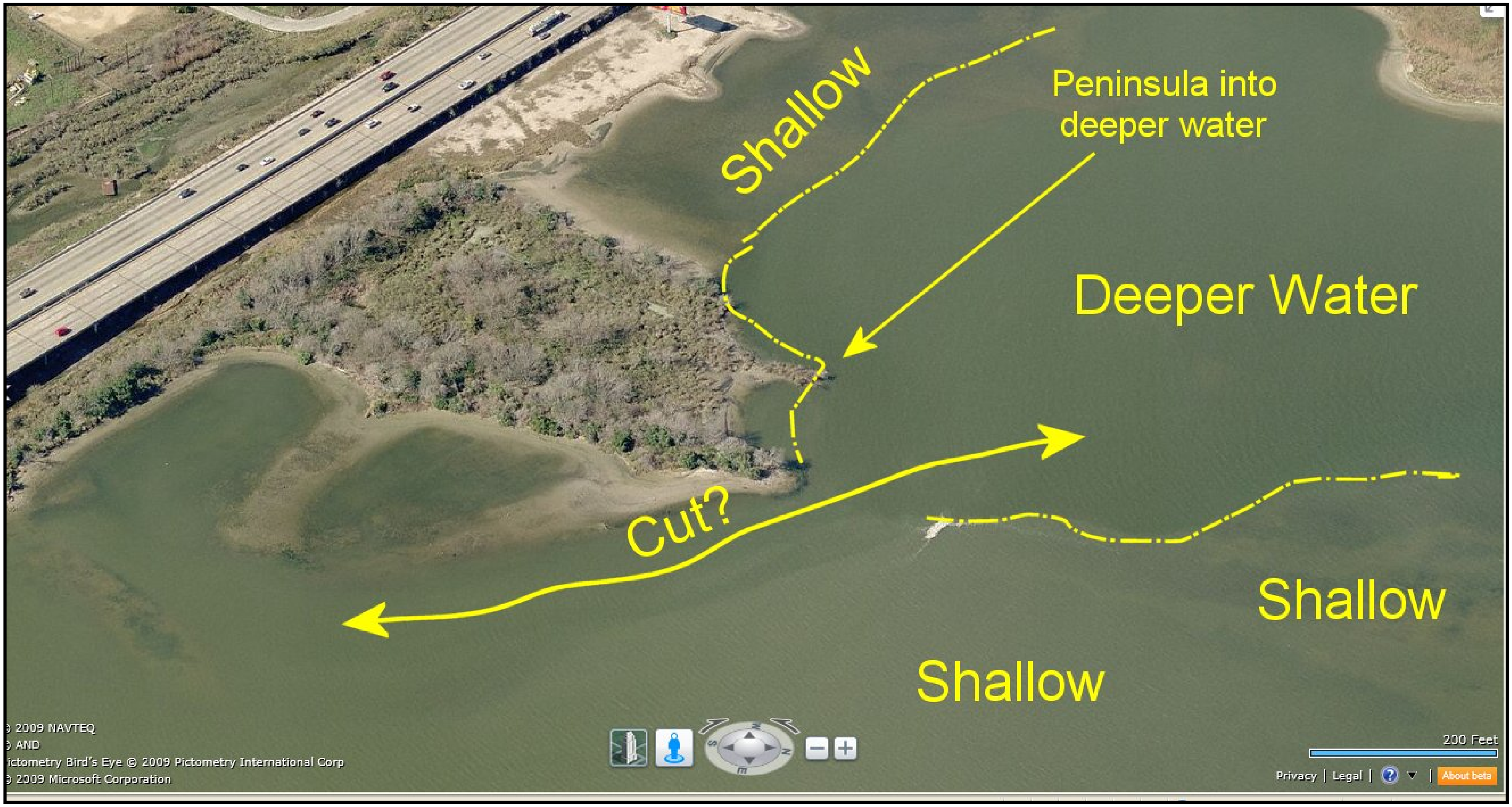


Figure 3
Oblique Photo of Waste Pit Site
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

ANCHOR QEA

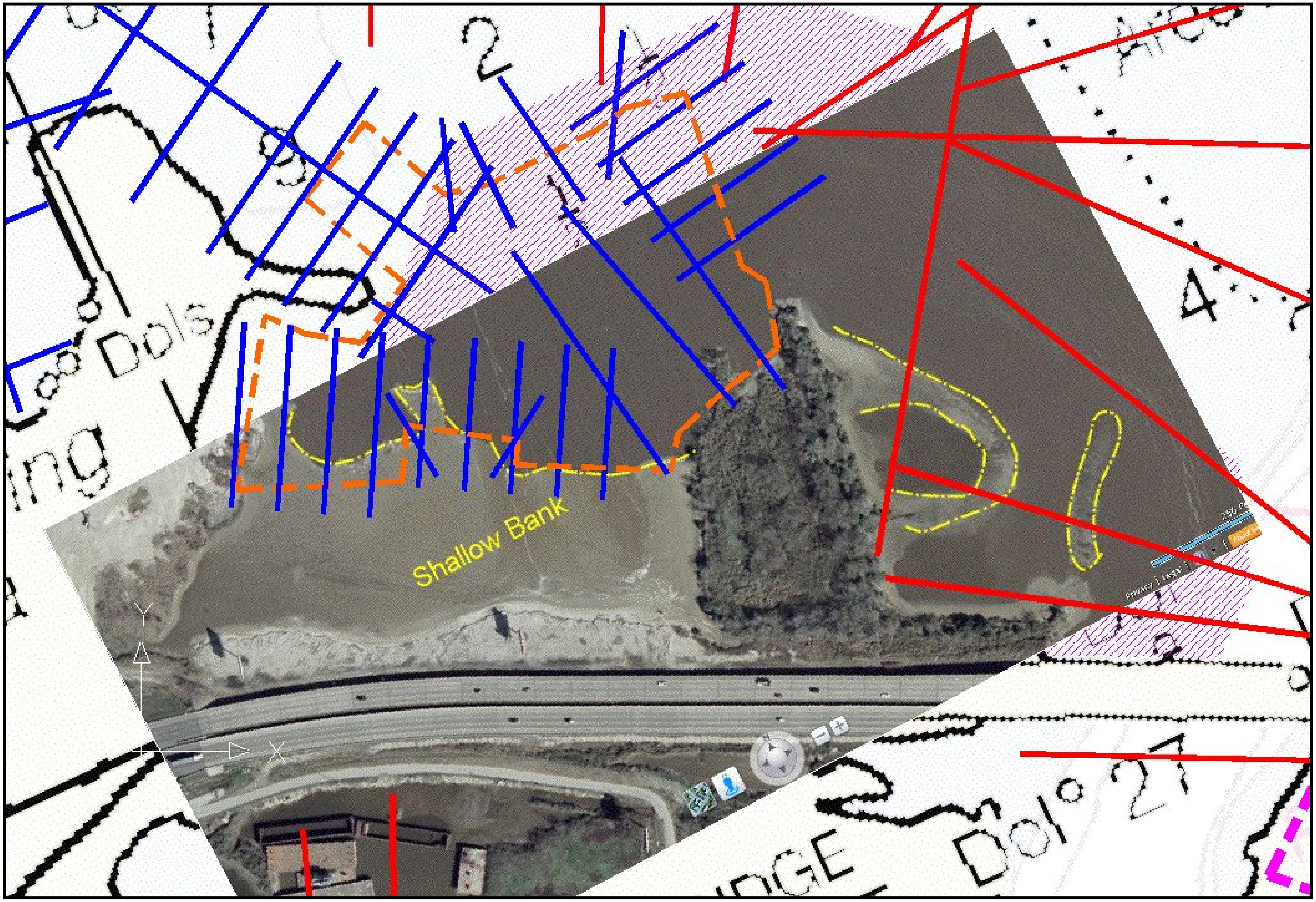


Figure 4
I-10 North Plan on Aerial Image of Waste Pit at Low Tide
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

ANCHOR QEA

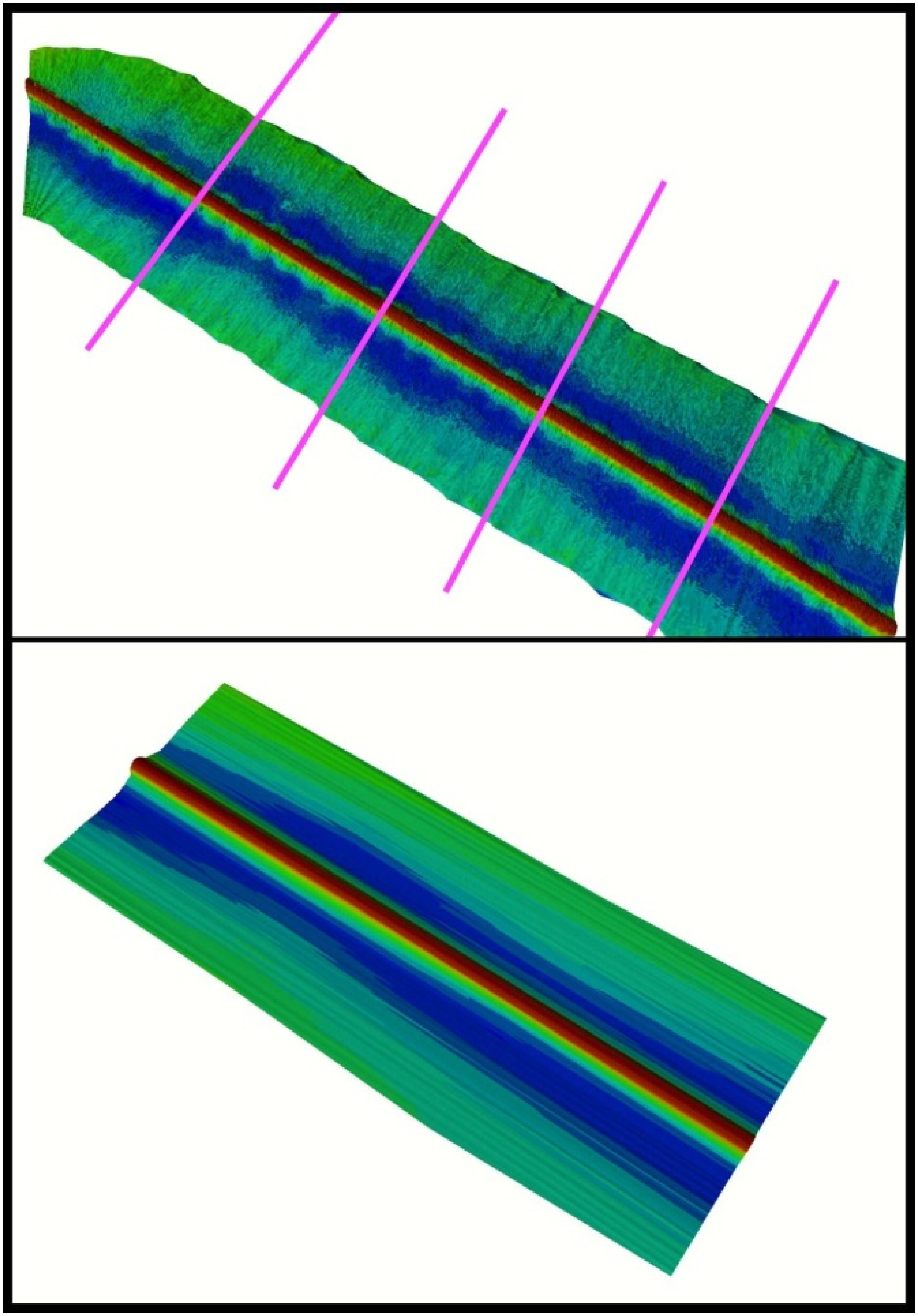


Figure 5
Survey Perpendicular to Contour
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

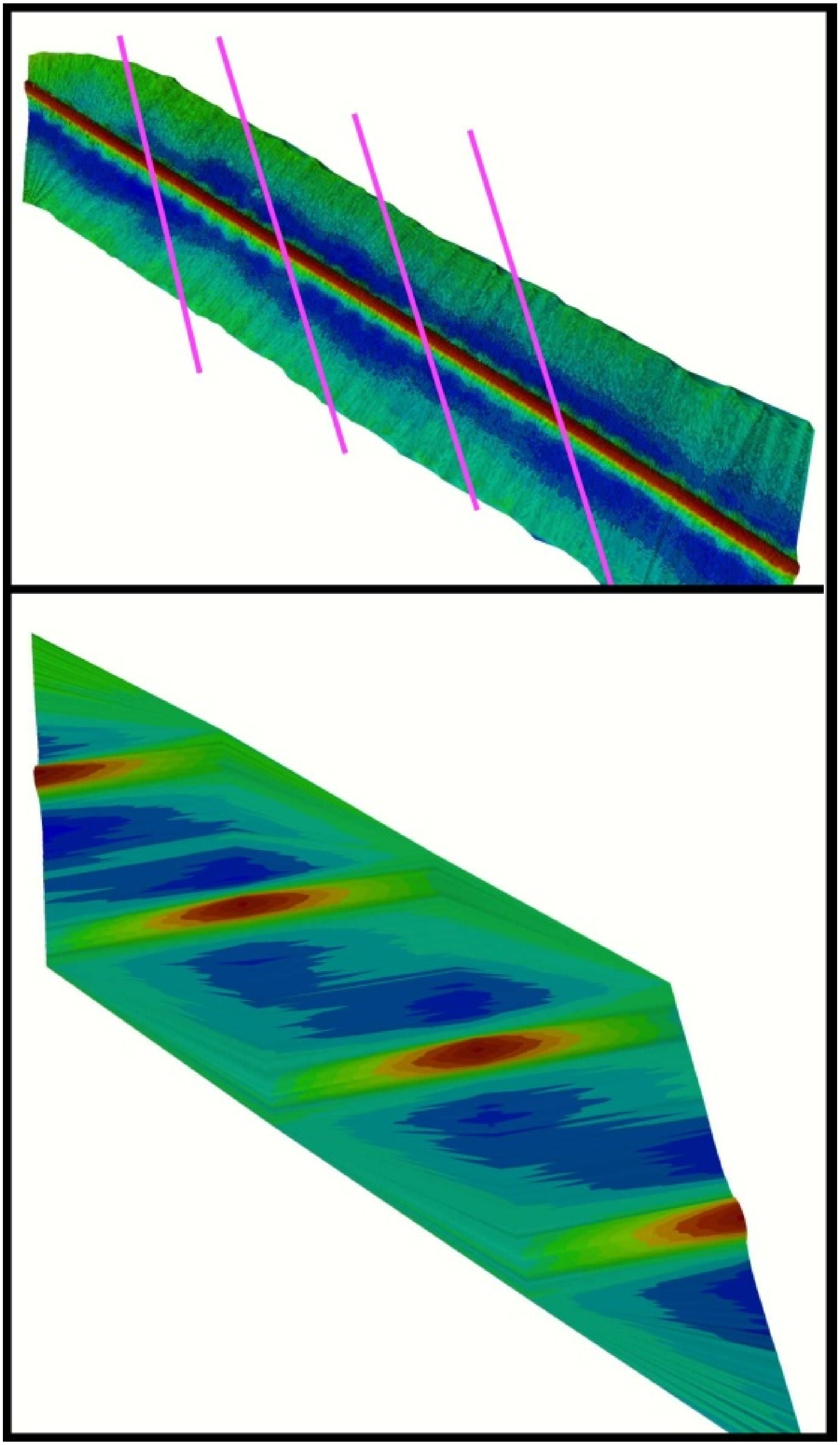


Figure 6
Survey Askew of Contour
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

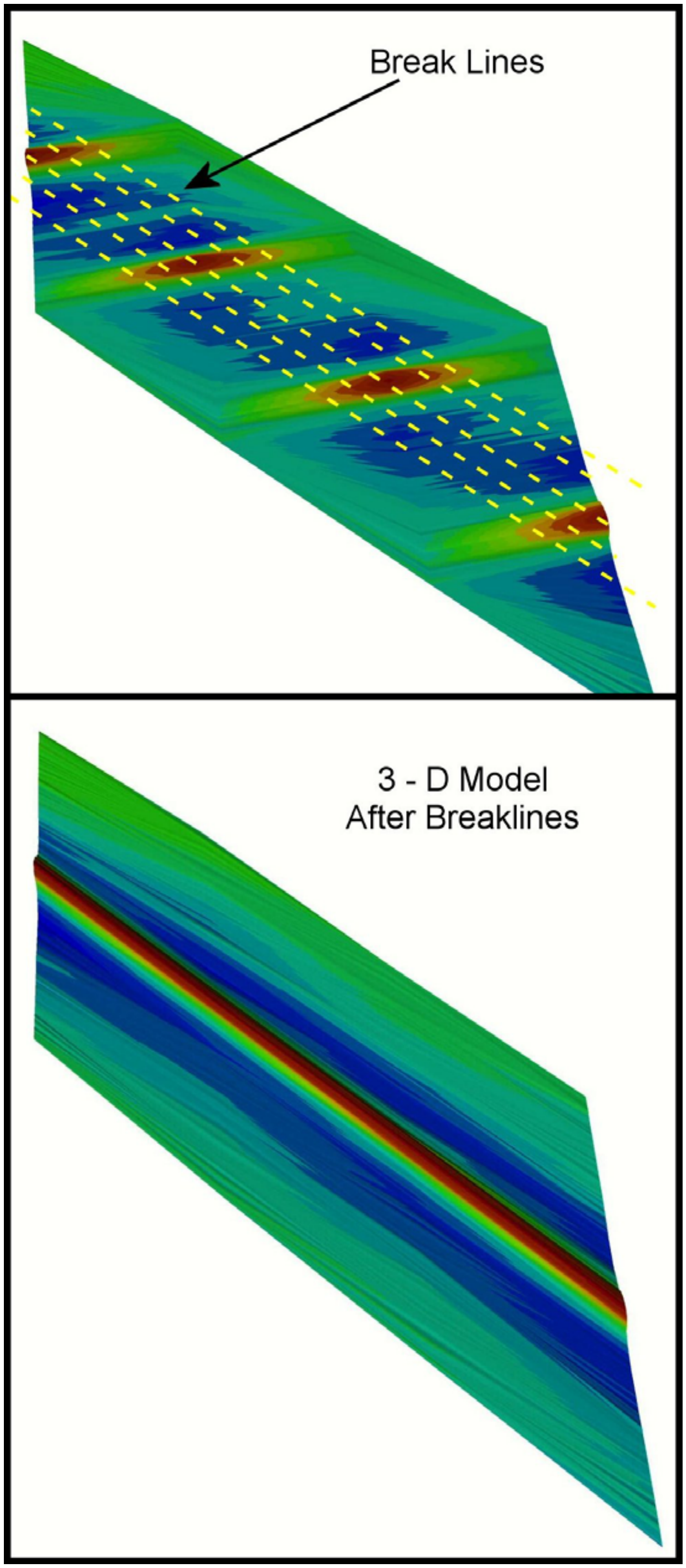


Figure 7
Break Line Aiding for 3-D Modeling
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

ANCHOR QEA

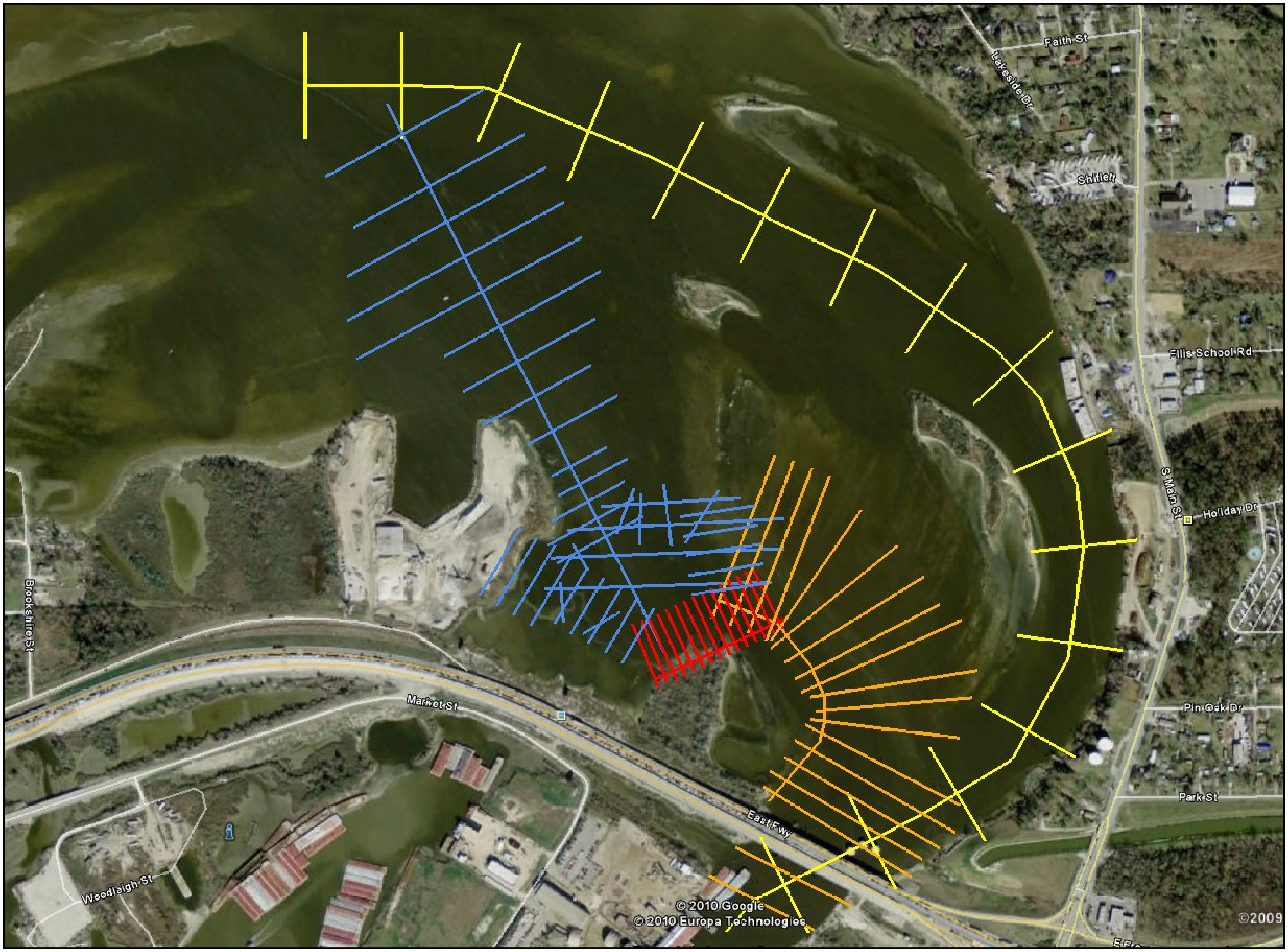


Figure 8
Revised Survey layout, June 2010
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site

ANCHOR QEA

Argonaut-SW

Useful options and accessories make the Argonaut-SW a complete, turn-key solution!

Real-time Flow Display: Provides an easy-to-use interface for monitoring both output data and the system status.

SW Mounting Shoe: This streamlined, hard plastic casing helps deflect sediment in canals, channels and pipes. Also has slots for pipe-ring mounting.

Modbus Interface Module (MIM): Integrate into any Modbus-enabled system using Modbus RS-232 protocol. Acting as an RTU slave device, the MIM stores data in a series of registers so it can be reported to the master unit in real-time.

Sliding Mount: Rail system for easy instrument deployment and retrieval. A modular design allows for multiple length and depth configurations.

Specifications

Standard Features

- 2-D velocity measurement (using 2 acoustic beams) along channel and vertical velocity components
- Water level measurement using vertical acoustic beam
- Automatically adjusts sampling volume location to measure the maximum possible portion of the water column
- RS-232/SDI-12 communication protocol
- Real-time flow calculations using user-supplied channel geometry
- 4 MB recorder capacity (over 50,000 samples)
- Temperature sensor
  - Resolution: ±0.01° C
  - Accuracy: ±0.5° C
- ViewArgonaut Windows 2000/XP/Vista software for instrument setup, data collection, and post processing.
- PDA software (SonUtils and deployment module)
- Multi-cell current profiling
- Mounting plate

Velocity Profiling Range

- Maximum Depth: 5.0m (16ft)
- Minimum Depth: 0.3m (1ft)*

Water Level Measurement

- Minimum Depth:
  - Above transducer: 0.10m (0.3ft)
  - Total water depth: 0.20m (0.6ft)
- Maximum depth: 5.0m (16ft)
- Accuracy: ±0.1% of measured level, ±0.3cm (0.01ft)

Water Velocity

- Range: ±5 m/s (16 ft/s)
- Resolution: 0.1 cm/s (0.003 ft/s)
- Accuracy: ±1% of measured velocity, ±0.5 cm/s (0.015 ft/s)

Optional Features

- FlowPack velocity indexing software
- 4-20 mA and 0-5VDC output modules; possible variables are X velocity, Y velocity, velocity magnitude, temperature, SNR, stage, volume and flow.
- Custom mounting shoe (at left)
- Deployment sliding mount (at left)
- Flow Display (at left)
- Durable plastic shipping case
- RS-422 for cable runs longer than 100m

SonTek
YSI incorporated

SonTek/YSI
9940 Summers Ridge Road
San Diego, CA 92121, USA
Tel: +1 (858) 546-8327
Fax: +1 (858) 546-8150
Email: inquiry@sontek.com

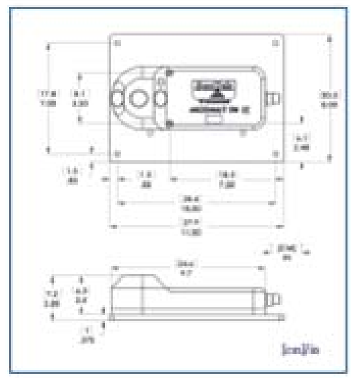
Physical Parameters

- Dimensions: 24.5cm (9.7 in) long by 10cm (4 in) wide by 6.3cm (2.5 in) high
- Weight:
  - In air: 1.2kg (2.6 lb)
  - In water: 0.15kg (0.3 lb)
- Pressure rating: 25m (80 ft)
- Operating temperature: -5°C to 60°C (23°F to 140°F)
- Storage temperature: 10°C to 70° (14° to 158°F

Power Requirements

- Input power: 5-15 VDC
- Power consumption: 500 mW nominal

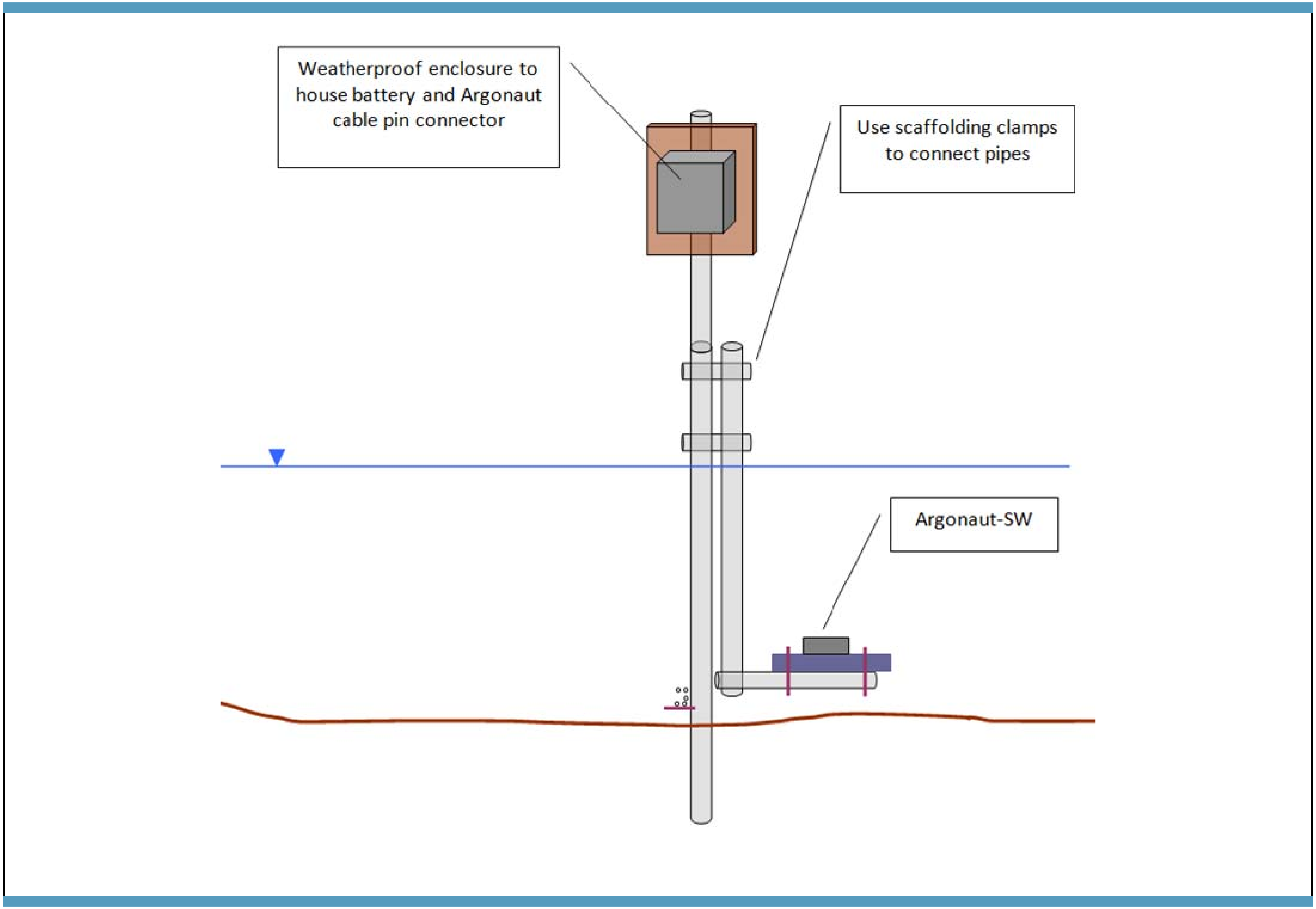
*Can operate in shallower depths down to 0.2m (0.7ft) with performance limitations. Contact SonTek for details.



SonTek/YSI, founded in 1992 and advancing environmental science in over 100 countries, manufactures affordable, reliable acoustic Doppler instruments for water velocity measurement in oceans, rivers, lakes, harbors, estuaries, and laboratories. SonTek/YSI is an employee-owned company.

sontek.com

Figure 9
SonTek Argonaut-SW ADCP Specifications Sheet
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site



ANCHOR QEA

Figure 10
SonTek Argonaut-SW ADCP Deployment
Hydrographic Survey and ADCP Data Collection
San Jacinto River Waste Pits Superfund Site